THE REGIONAL MUNICIPALITY
OF HAMILTON WENTWORTH

IMPROVEMENTS
TO

GRAYS
ROAD

PARKER
ASSOCIATES

IMPROVEMENTS TO

GRAYS ROAD.

FROM BARTON STREET NORTHERLY
TO COMMUNITY AVENUE
INCLUDING A GRADE SEPARATION
AT THE C.N.R. MAINLINE
MILEAGE 36.97
GRIMSBY SUBDIVISION

PARKER ASSOCIATES

DECEMBER 1978

Mr. W.A. Wheten, P. Eng.
Commissioner of Engineering
Regional Municipality of Hamilton-Wentworth
Engineering Department
71 Main Street West
Hamilton, Ontario
L8N 3T4

Attention: Mr. H.O. Schweinbenz, P. Eng.

Dear Sir:

Improvements to Grays Road
Barton Street to Community Avenue

We are pleased to submit our Preliminary Design Report for the Improvements to Grays Road between Barton Street and Community Avenue including a Canadian National Railways main-line grade separation.

This report includes a summary of the major technical features of the project including preliminary details and costs associated with the road improvements and the grade separation structure. It also provides the necessary documentation for Canadian Transport Commission approval.

We thank you for the opportunity to assist the Region in conducting this study and appreciate the co-operation of you and your staff during the course of the project.

We trust that this report will provide you with the necessary information to proceed with the design and implementation of this project.

Yours truly
PARKER ASSOCIATES

D.W. Coutts, P. Eng.
Project Manager

CONTENTS

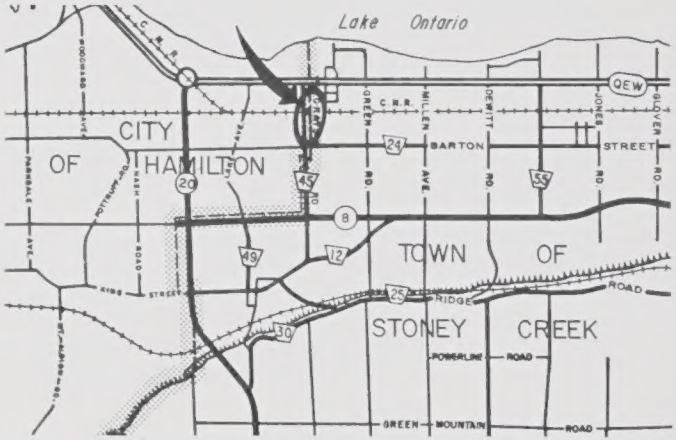
INTRODUCTION

Grays Road extends from the base of the escarpment, in the Town of Stoney Creek, northerly across the QEW to Lake Ontario. From just south of Barton Street to the north limits, Grays Road is within the City of Hamilton. Major intersections on Grays Road include King Street, Highway 8, Barton Street and the North and South Service Roads of the QEW with an over-pass of the QEW. The section of Grays Road generally between King Street and Barton Street has recently been constructed to a four lane urban standard.

The portion of Grays Road within this study extends from just south of Arvin Avenue (which is some 650 feet north of Barton Street) northerly to Community Avenue, a distance of some 2250 feet. This portion of Grays Road is presently two lanes wide and is in very poor physical condition.

As described in the terms of reference provided to the Consultant, the project includes:

- complete reconstruction, to a four lane curb and gutter cross section, the existing two lane road between Arvin Avenue and Community Avenue;
- the complete construction of a grade separation to accommodate a four lane road facility and all utilities at the Canadian National Railway main line.



LOCATION PLAN **Exhibit 1**

EXISTING CONDITIONS

GRAYS ROAD

Grays Road is part of the Regional Municipality of Hamilton-Wentworth road system between King Street and the QEW. Within the limits of this study, this road serves an arterial function for abutting industrial land uses.

Grays Road (within the study limits) has a maximum grade of approximately 5 percent and a road surface of 22 to 24 feet in width with shoulder widths of 8 to 10 feet. There is no curb and gutter over most of the project length. The road allowance is generally 76 feet with widening in the vicinity of the CN crossing.

The CN two track line presently crosses Grays Road at-grade and is equipped with automatic signals and gates.

INTERSECTING ROADWAYS

Within the project limits, there are several intersecting collector roadways as shown in Exhibit 2. Milburn Road and Burford Road serve primarily local industrial access. Community Avenue, the north limit of the project, connects to the south service road of the QEW by way of Pinelands Avenue. The Arvin Avenue connection to Grays Road has recently been completed and lines up with the Milburn Road intersection. Grays Road southerly from this project has been constructed to a four lane urban undivided roadway.

SERVICES AND UTILITIES

There are two trunk services, a 48/72 inch storm sewer and a 18/24 inch sanitary sewer which extend throughout the limits of the project basically centred on the existing road. These services were located to accommodate road construction underpassing the railway. Storm catchbasins also were located to allow for four lane construction.

A 16 inch watermain also extends throughout the limits of the project along the west side of the existing road.

A 6 inch gas line is located on the east side of the present roadway some 6 to 10 feet inside the right-of-way line.

A Bell cable line extends along the east side and a Hamilton Hydro pole line along the west side of the present roadway. The Hydro line includes street lighting luminaires located at 200 to 250 foot intervals.

An Ontario Hydro tower line and also a pole line crosses Grays Road along the north side, and parallel to, the CN tracks. A CN telecommunications line crosses Grays Road along the south side of the CN tracks.

LAND USE

The land abutting Grays Road within the limits of this project has mostly been developed as a major industrial zone. Several residential properties remain on the east side of Grays Road north of the CN crossing. (Refer to Exhibit 2).

ACCESS TO ABUTTING PROPERTIES

Access is presently provided to industrial properties on either side of Grays Road within the limits of this study. A one foot reserve exists along the west side of Grays Road from Milburn Road to the South Service Road. The right of access can therefore be terminated to abutting properties on the west side given appropriate notice by the Municipality. Access to properties on the east side will need to be retained as part of the road improvement plan.

NATURAL ENVIRONMENT

A field inspection of the natural features of the area was carried out by Ecoplans Ltd. of Waterloo on November 9, 1977. All shrubs and trees were assessed on the basis of biological health and vigour and characterized by species, size, form and quality.

Herbaceous vegetation was not assessed due to the late field season.

Grays Road vegetation is indicative of new commercial-industrial areas, varying from abandoned, weed-colonized fields, through old non-productive orchards, to recently sodded and landscaped green spaces in front of industrial buildings. The older residential buildings are typically landscaped with foundation junipers or cedars, roses and privet hedges. A few weeping willows are located on front lawns of these homes.

The vegetation along Grays Road is not considered to be significant, and can as easily be replaced or preserved. The few large willows located on residential front lawns are attractive, but are approaching the size where their roots interfere with sewers or watermains and the large limbs become wind-hazards.

A copy of the complete report is included in Appendix A.

SOILS INVESTIGATION

A field boring program was carried out by the Trow Group Limited on September 28, 1977, at the site of the proposed grade separation. The investigation was undertaken to examine the geotechnical conditions at the site in order to present preliminary design data and to comment on construction procedures and possible problems from a soil mechanics standpoint. The complete report is included as Appendix B.

The significant material encountered was brown to grey silty clay till with traces of sand and gravel. The consistency profile shows that the soil is hard in the upper 12 feet of the weathered crust, generally very stiff for the next 40 feet and hard below the 52 foot depth. Bedrock was not encountered and is considered to be below the 70 feet depth. The stabilized ground water is estimated to be at approximately elevation 260.

Geotechnical conditions at the site for the proposed grade separation indicate that the most suitable foundation alternative for the structure is conventional spread footings founded at fairly shallow depths in the silty clay till.

The footings should be designed for an allowable bearing capacity of 4 tons per square foot above elevation 260 and 2 tons per square foot below that level. At least 4 feet of cover should be provided to protect the footings from frost action.

Approach embankments for a grade separation would be at least 15 feet high. Side slopes of 2 horizontal to 1 vertical should be stable if constructed as recommended in the report.

The comments in this section are based on subsurface information obtained for one boring. Prior to the preparation of final design, at least one additional borehole should be undertaken to verify that the soil conditions are similar across the site, to obtain samples for possible further laboratory tests and to establish the level of bedrock for possible piled foundation design.

TRAFFIC

VEHICULAR VOLUMES

Traffic counts carried out in 1977 were provided by the City of Hamilton on Grays Road at the following intersections:

- Barton Street
- Milburn Road
- Community Avenue

In addition, an 8 hour manual count was carried out at the intersection of Burford Road with Grays Road in November 1977. The estimated 1977 Average Annual Traffic (AADT) on Grays Road and the intersecting roadways within the limits of this project are as follows:

	Estimated 1977 AADT
Grays Road (at CN)	5800
Milburn Road	1800
Burford Road	1400
Community Avenue	4900

Traffic projections for 1987 as outlined in the Ministry of Transportation and Communications, Ontario, report "Truck Access Study" indicate a factor increase of about 1.8 over the 1977 volumes.

As tabulated above, the 1977 AADT on Grays Road in the vicinity of the CN crossing is 5800 vehicles with about 11 percent trucks. The a.m. and p.m. turning movements are relatively low with the exception of Barton Street (which is beyond the limits of this project) and Community Avenue. This latter street provides access to the QEW via Pinelands Avenue and the South Service Road. Exhibit 3 illustrates present and projected turning movements at the intersections within the limits of this study.

RAIL TRAFFIC

The present rail traffic as provided by CN is as follows:

- 16 freight trains per day (speed 60 mph)
- 6 passenger trains per day (speed 65 mph)
- 10 separate switching moves

It is anticipated by CN that rail traffic will increase at approximately 5 percent per annum. This would result in a 1987 rail traffic forecast of 52 train movements per day.

EXPOSURE FACTOR

The exposure factor, which is the number of trains per day multiplied by the average annual daily traffic, is a guide in determining the justification for a grade separation. Generally, if the exposure factor exceeds 150,000 in an urban area a grade separation is warranted.

Estimated exposure factor:

1977	-	5,800 AADT x 32	185,600
1987	-	10,500 AADT x 52	546,000

As set out above, the 1977 exposure factor significantly exceeds the minimum warrant and the 1987 estimate is more than 3.6 times the warrant for a grade separation.

ROADWAY REQUIREMENTS

Based on the present traffic patterns and anticipated rate of growth of traffic on Grays Road and intersecting roadways, a four lane section for Grays Road would provide the flexibility to accommodate vehicular flows within the forseeable future. On the basis of 1987 traffic projections, there would be residual capacity of some 50 percent.

This four lane section would be compatible with the reconstruction of Grays Road to four lanes adjacent to this project (to the south).

The proposed basic functional elements are as follows:

Number of lanes	-	4
Lane width	-	11 feet
Maximum grade	-	5 percent
Curb and gutter	-	barrier, continuous both sides
Median	-	within the vicinity of the grade separation only
Right of way	-	86 feet (basic)
Functional classification and design speed	-	urban arterial undivided (industrial) 35 mph
Minimum stopping sight distance, 240 feet	-	corresponding visibility curve 400 feet
Sidewalk	-	5 feet, continuous both sides

RAILWAY REQUIREMENTS

There will utimately be a requirement for five tracks at this location. However, the initial construction of the grade separation will accommodate three tracks (the two existing plus a new track on the north side). The structure abutments will be designed and located to allow construction of two more tracks on the south side, as required by CN.

For subway alternatives, vehicular clearance requirements from the roadway to the underside of a subway structure will require the main line tracks to be raised by two feet.

ALTERNATIVE PLANS

Three alternative plans within the limits of the grade separation and approaches have been prepared. These are designated Schemes A, B and C. The major features of each scheme are discussed below:

GENERAL DESCRIPTION

Scheme A (Exhibit 4)

With reference to Exhibit 4, this scheme involves the construction of 4 lanes extending from some 250 feet south of Arvin Avenue northerly to 175 feet north of Community Avenue. A subway type of grade separation (roadway under the railway) would be provided at the CN crossing. The roadway would be centred on the proposed basic road allowance of 86 feet (the present road allowance is now 76 feet; widening of 10 feet is proposed on the east side).

A retaining wall some 200 feet in length would be required on the west side, north of the CN to alleviate any affect on the properties in that area. On the east side, as noted previously, a 10 foot strip of property will be acquired to attain an 86 foot road allowance. In addition to this 10 foot acquisition, additional property amounting to about 0.5 acres will need to be acquired to accommodate the back slopes on the approaches to the subway structure. This additional acquisition would be required from the following properties:

- Intermediate Terminal Warehouses Ltd.
- CN Rail
- Ontario Hydro
- Mountain Mobile Maintenance Ltd.
- Residential property 448

Access is not provided to properties on the west side of Grays Road (a one foot reserve extends along the west side of the road allowance). On the east side, access is provided at existing entrances or, in the case of Mountain Mobile Maintenance, to their proposed assembled land. Access is not provided to the CN property (east of Grays Road and south of the CN right-of-way) and to Ontario Hydro (north of CN right-of-way, east and west of Grays Road).

The estimated total cost for this Scheme A including road and subway construction, railway work, property, and utility relocations is $2,019,000.

Scheme B (Exhibit 7)

This Scheme, as illustrated in Exhibit 7, is very similar to Scheme A. The difference from Scheme A is that the horizontal alignment is shifted easterly in the vicinity of the grade separation which results in additional property requirements over Scheme A. The reason for this alignment shift is to negate the need for a retaining wall on the west side, north of the CN, as is shown under Scheme A. A retaining wall will, however, be required on the east side in front of Mountain Mobile Maintenance if their present facilities are retained.

Property requirements beyond the proposed basic 86 foot right-of-way would total about one acre and would include acquisition from the following:

- Intermediate Terminal Warehouses Ltd.
- CN Rail
- Ontario Hydro
- Mountain Mobile Maintenance Ltd.
- Residential property 448
- Residential property 452
- Pine Nuk Enterprises

The grade separation at the CN would be a subway similar to Scheme A. Access to adjacent properties would be as discussed under Scheme A.

The estimated total cost for this Scheme B is estimated at $2,019,000, the same as for Scheme A.

Scheme C (Exhibit 8)

As illustrated in Exhibit 8, this Scheme involves the construction of 4 lanes with an overpass structure at the CN (the roadway over the railway) basically centred on the proposed 86 foot road allowance. With the roadway over the railway, fill sections on the structure approaches would reach a maximum height of some 27 feet. A retaining wall some 600 feet in length would be required on the west side of Grays Road north of the CN to alleviate impact on properties in this area.

Property requirements beyond the basic 86 foot right-of-way would be significantly higher than either Schemes A or B - in excess of

of two acres - and would include acquisition from the following:

- Intermediate Terminal Warehouses Ltd.
- CN Rail
- Ontario Hydro
- Mountain Mobile Maintenance Ltd.
- Residential property 448
- Residential property 452
- Pine Nuk Enterprises
- HGH Developments Ltd.

Access would not be provided to adjacent properties along the west side as is the case for Schemes A and B. On the east side, access to properties north of the CN could only be provided by means of a service road is illustrated in Exhibit 8. South of the CN, only one of the two access points presently servicing Intermediate Terminal Warehouses Ltd. could be provided. Existing access to the Thermoking property can be retained.

The estimated total project cost would be in excess of $2.5 million.

EVALUATION AND PLAN SELECTION

Schemes A and B are essentially the same with the exception of the alignment shift to the east at the grade separation. This alignment shift was initially considered, and had some merit, if Mountain Mobile Maintenance facilities were to be acquired. If they were acquired, then retaining walls would not be required on either side of the roadway. Mountain Mobile Maintenance has since expressed their intention to remain at their present location, possibly assemble additional land to the north and modify their facilities to allow access from the north.

There is therefore no advantage to shift the alignment easterly and therefore no advantage of Scheme B over Scheme A.

Scheme C, with the roadway over the railway, has the advantage over Scheme A and B in that a railway detour is not required and raising of the main line tracks is not necessary.

These advantages are far outweighted, however, by the following considerations:

- significantly higher construction costs, with Scheme C some 25 percent higher than Scheme A
- a higher degree of property impact and resulting acquisition requirements
- the visual obtrusion of the high fills with the roadway overpass
- no advantage of Scheme C over Scheme A in terms of traffic operational and capacity features which implies the cost/effectiveness is considerably less attractive than Scheme A.

It is therefore recommended that Scheme A be selected for implementation.

THE RECOMMENDED PLAN (Scheme A)

ROADWAY ELEMENTS

The horizontal alignment of the roadway is on tangent throughout the project. The vertical alignment geometrics satisfies 35 mph design standards in terms of sight distances and is in excess of 50 mph design standards in terms of maximum grades. (Refer to Exhibit 4).

The basic road cross section has four - 11 foot lanes, with a 13 foot boulevard and 5 foot sidewalk on each side. (Refer to Exhibit 5).

Within the subway approaches, a raised median, varying in width up to a maximum of 12 feet at the centre piers is provided, beginning some 300 feet either side of the structure centreline. Also within the approaches, the sidewalks are located immediately adjacent to the roadway.

SUBWAY STRUCTURE

It is proposed that the subway structure be concrete, two span, and would be built initially to accommodate the existing two tracks plus a new track to the north. The abutments would be constructed, however, to allow for the future construction of two additional tracks for an ultimate total of five. (Refer to Exhibit 6).

PROPERTY

As discussed previously, the road allowance is now a basic 76 feet with widening on the west side south of the CN. It is proposed to widen by 10 feet on the east side throughout the project to provide a basic 86 foot road allowance compatible with the adjacent section of Grays Road to the south. Some 0.27 acres of property would be required for this widening. In addition, some 0.55 acres of property will be required on the east side to accommodate the approach cut slopes. Property acquisition beyond the 86 foot right-of-way would be required from the following:

- Intermediate Terminal Warehouses Ltd.
- CN Rail
- Ontario Hydro
- Mountain Mobile Maintenance Ltd.
- Residential Property 448

ACCESS

Under the recommended plan, access is not provided to abutting properties on the west side of Grays Road. As discussed, a one foot reserve extends along the west side of Grays Road between Milburn Road and Burford Road. Access to abutting properties will be gained via these two collector roads.

On the east side, access is provided at existing entrances and at the proposed assembled property of Mountain Mobile Maintenance. Access to H.G.H. Developments Ltd. is not indicated at this time.

Several access points will require construction beyond the road allowance in order to provide satisfactory grades from the revised road profile. These include:

- Intermediate Terminal Warehouses Ltd.
- Property 448 (to be acquired and a new access constructed at this location to serve Mountain Mobile Maintenance)
- Property 452
- Pine Nuk Enterprises

UTILITY AND SERVICE RELOCATIONS

The following services and utilities will require relocation or adjustment:

a) Ontario Hydro

Two plant relocations are necessary north of the CN and west of Grays Road

- a 276 KV Ontario Hydro Pole
- a 115 KV Ontario Hydro Structure

b) Hamilton Hydro

Within the limits of the subway approaches about 10 poles will need to be relocated to immediately behind the proposed sidewalk on the west side.

c) Bell Canada

Bell Canada is proposing to relocate their facility by means of an underground cable along the east side of the roadway, 9 feet inside the right-of-way line.

d) Union Gas Limited

The 6 inch gas line which extends over the length of the project will need to be adjusted within the subway approach section.

e) Regional Services - Water

The 16 inch watermain will require adjustment and relocation in the vicinity of the structure as illustrated.

ILLUMINATION

The present level of illumination appears to be adequate for this class of road and for the nature of abutting land use, with the exception of immediately north of the proposed subway structure.

Provision is therefore made for relocating the present system with an additional luminaire on the north side of the subway within the subway approach.

LANDSCAPING

Comments on post construction landscaping are included in Appendix A, National Environmental Features. The main points are summarized as follows:

- a unified landscaping program should be implemented that is aesthetically attractive, biologically functional and of low maintenance. This could include the co-operation of abutting properties in developing an overall landscaping program.

- utilization of turf (Kentucky Blue Grass) should be minmized, with perennial ground covers substituted.

- shrubs and trees should be selected on the basis of site suitability, wildlife habitat and screening ability. Mixtures of native viburnum, dogwoods, sumacs, with southern hardwoods (e.g. black gum, sassafras, black oak or sycamore) would be ideal along the railway lines, between buildings and the road, or surrounding parking lots.

ROADWAY DETOUR

A roadway detour will be required during construction of the subway to maintain traffic along Grays Road. This detour would be located on the east side of the structure - the approximate location is shown in Exhibit 9.

Temporary signals will be provided at the road detour/rail diversion intersection to control traffic during the construction period.

RAILWAY DIVERSION

In order to maintain traffic during construction of the subway, it is proposed that a rail diversion be constructed to the south of the main line as illustrated in Exhibit 9.

To construct this rail diversion as illustrated in Exhibit 9, a construction easement will be required from the Carter Welding Supplies Ltd. property. In order to achieve acceptable alignment of the diversion, the distance from the gauge side of the near rail to the nearest point of an above ground propane gas storage tank on Carter property is 20 feet. This separation would appear to satisfy the separation requirements of the Canadian Transport Commission for tracks other than main tracks.

Since the speeds of the trains on the diversion will be limited to 20 mph and also since it is a temporary facility it would appear that this solution would be satisfactory.

The owners of the property have indicated general agreement with the diversion scheme provided that adequate safety measures are implemented as part of the plan.

The other alternative, that is, the rail diversion located on the north side of the main tracks, was explored and several significant problems have emerged. An Ontario Hydro tower line is located adjacent to, and parallel to the CN along the north side. The additional cost to relocate Ontario Hydro facilities is about $15,000.

A more significant problem associated with the diversion to the north side involves the Mountain Mobile Maintenance leased property adjacent to the Ontario Hydro right-of-way in the northeast quadrant of the proposed grade separation. Their operation involves the lease of Ontario Hydro property adjacent, and to the south, of their building. They utilize this property to gain access to their building for large trucks and also for parking. If this Hydro property is utilized for a rail diversion, Mountain Mobile Maintenance Ltd. has estimated their costs at $37,000 to modify their building and access assuming that properties now owned by the Municipality to the north of their site would be made available for their use.

In addition to the above costs to modify their operation, there would be other costs associated with detrimental impacts on their business. For example, there would be a reduction of working space by about 40 percent during building alterations and there would also be dust levels which are not compatible with their maintenance operation.

In summary, it is evident that a rail diversion to the north would have a severe impact on the operation of Mountain Mobile Maintenance even if some $37,000 were spent on modifications. If a new facility for their operations was built utilizing the three lots to the north, the cost of the building is estimated at $120,000.

We therefore recommend that the rail diversion should be located to the south of the main line and appropriate measures carried out to ensure a safe operation of rail movements along the detour during the construction period.

SUMMARY

COST ESTIMATE - RECOMMENDED PLAN

	Within Limits of Subway Approaches	Outside of Subway Approaches
Structure	$ 347,200	
Retaining Wall	80,000	
Roadworks • all works associated with reconstruction of Grays Road including landscaping and road detour	410,800	$ 110,600
Railway Works • earth work and sub ballast for main line and rail diversion	39,300	
• trackage, ballast, signals, telecommunications	448,400	
Utilities	129,700	56,000
Property	143,000	7,000
Engineering and Contingencies	219,300	27,700
Totals	$1,817,700	$ 201,300

SUMMARY

COST SHARING - RECOMMENDED PLAN

Federal Ministry of Transport, Special Grant		$1,340,620
Canadian National Railways		90,880
Public Utilities		78,420
Ontario Hydro		
Hamilton Hydro	$13,310	
Bell Canada	57,500	
Union Gas	7,610	
Ministry of Transportation and Communications		254,540
Regional Municipality of Hamilton-Wentworth		254,540
Total		$2,019,000

EXHIBITS

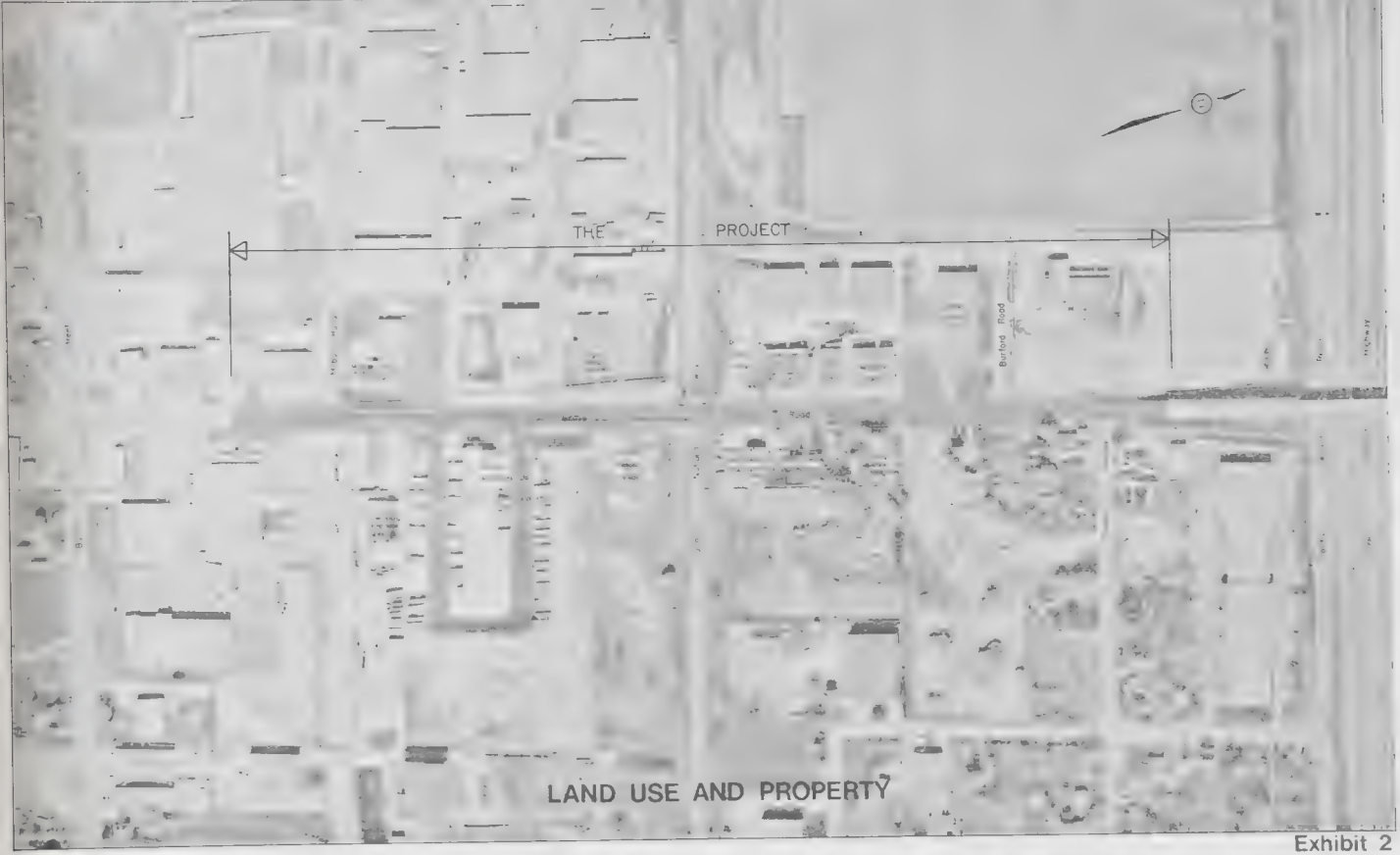
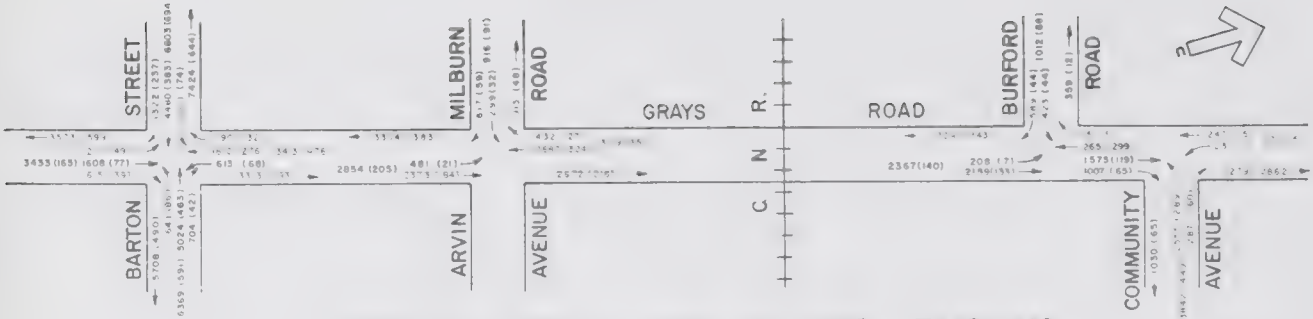
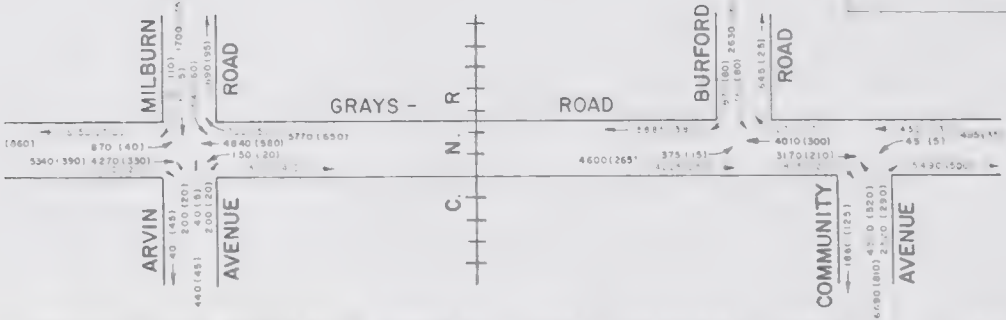


Exhibit 2



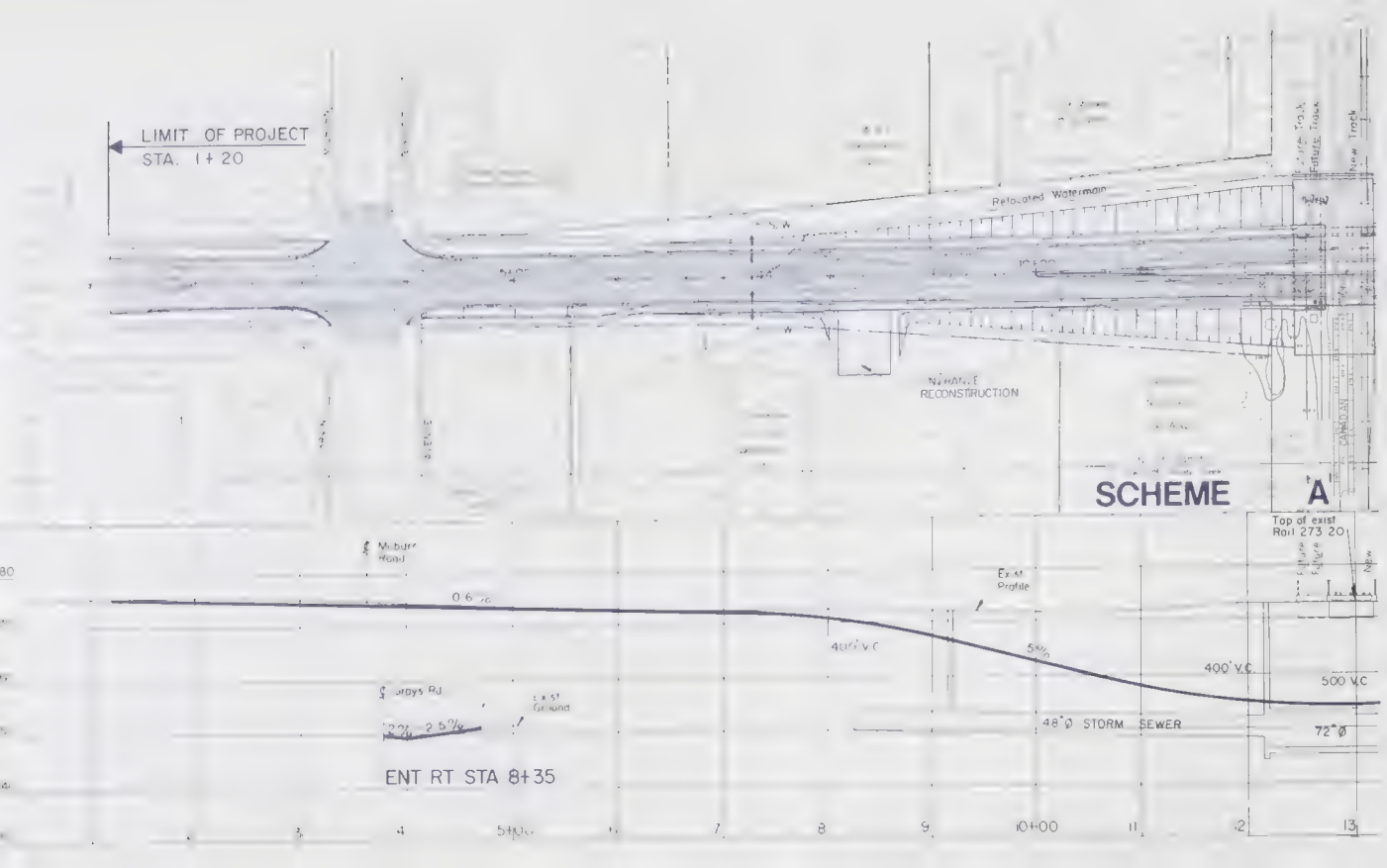
AVERAGE ANNUAL DAILY TRAFFIC - EXISTING

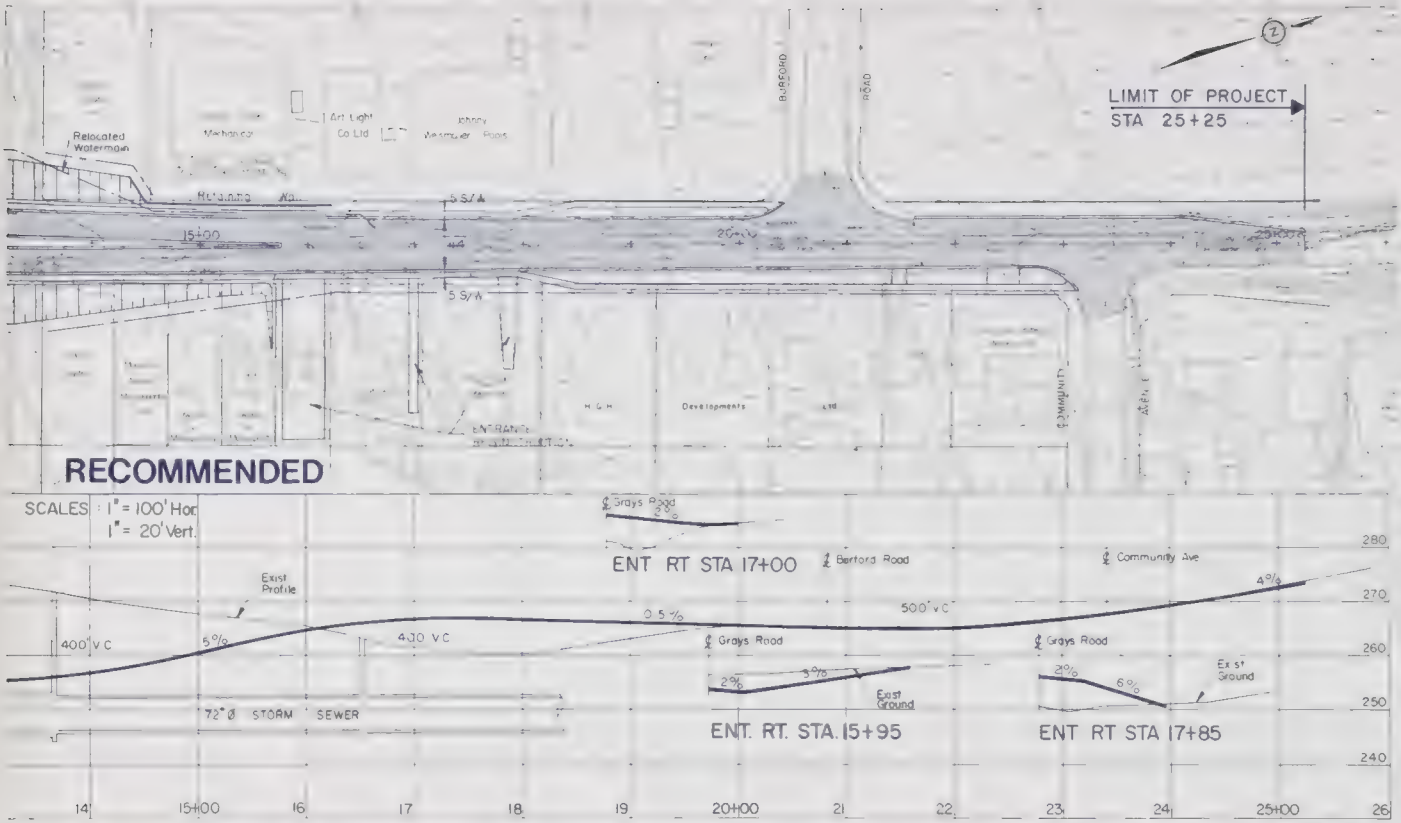
LEGEND
5175 - AVERAGE ANNUAL DAILY TRAFFIC
(2651- PEAK HOUR TRAFFIC



PROJECTED AVERAGE ANNUAL DAILY TRAFFIC - 1987

Exhibit 3


LIMIT OF PROJECT
STA. 1+20
Relocated Watermain
NORMAL RECONSTRUCTION
SCHEME A
Top of exist Rail 273.20
Exist Profile
0.6 %
400' V.C
5%
400' V.C
500' V.C
48"Ø STORM SEWER
72"Ø
ENT RT STA 8+35
10+00


LIMIT OF PROJECT
STA 25+25
Relocated Watermain
Mechanical
Art Light Co Ltd
Johnny Mercury Foods
Retaining Wall
5 S/A
15+00
20+00
25+00
5 S/A
H. G. H
Developments
Ltd
ENTRANCE
BEDFORD
ROAD
COMMUNITY
AVE
RECOMMENDED
SCALES : 1" = 100' Hor
1" = 20' Vert.
℄ Grays Road
3%
ENT RT STA 17+00
℄ Bertord Road
℄ Community Ave
Exist Profile
400' V C
5%
430' V C
0.5%
500' V C
4%
℄ Grays Road
2%
3%
Exist Ground
℄ Grays Road
2%
6%
Ex st Ground
72" Ø STORM SEWER
ENT. RT. STA. 15+95
ENT RT STA 17+85
280
270
260
250
240
14
15+00
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20+00
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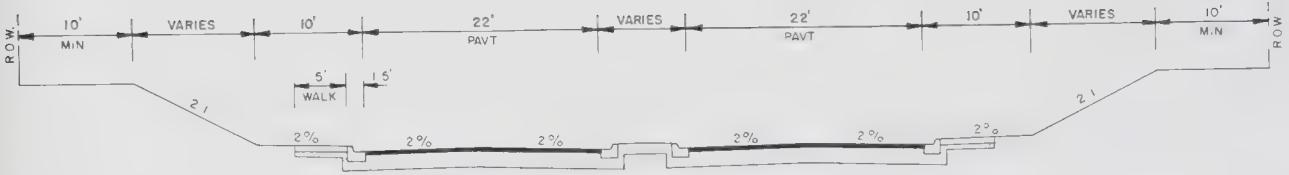
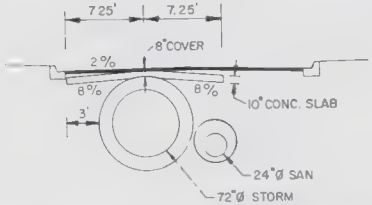
24
25+00
26

Exhibit 4



ROADWAY - SUBWAY APPROACH

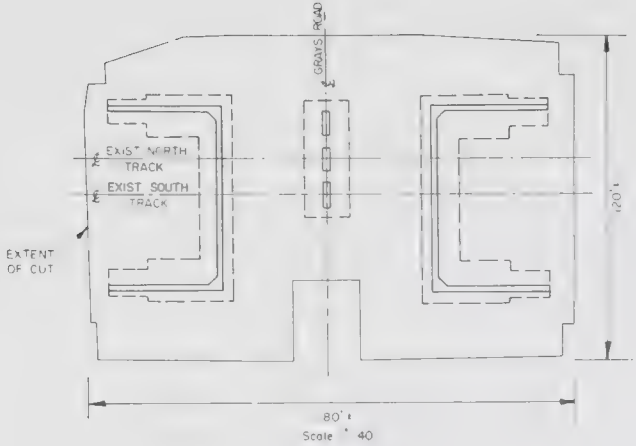
ROADWAY



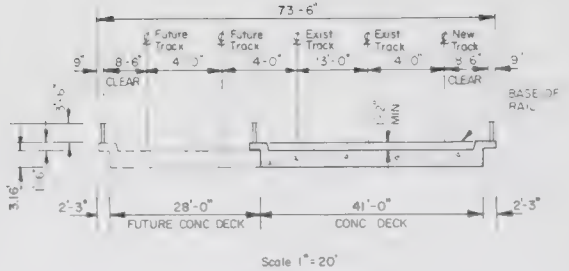
ROAD AND SEWERS AT SUBWAY

TYPICAL SECTIONS

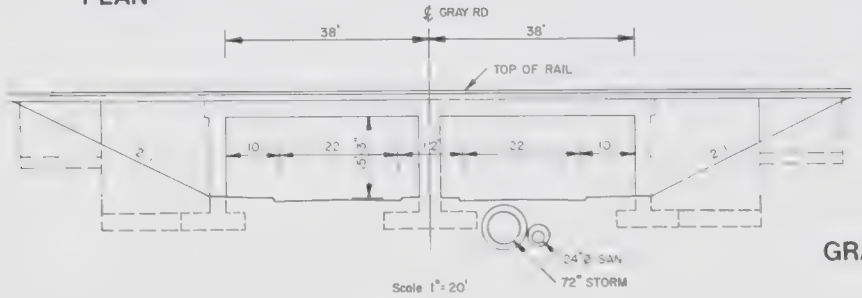
Exhibit 5



PLAN



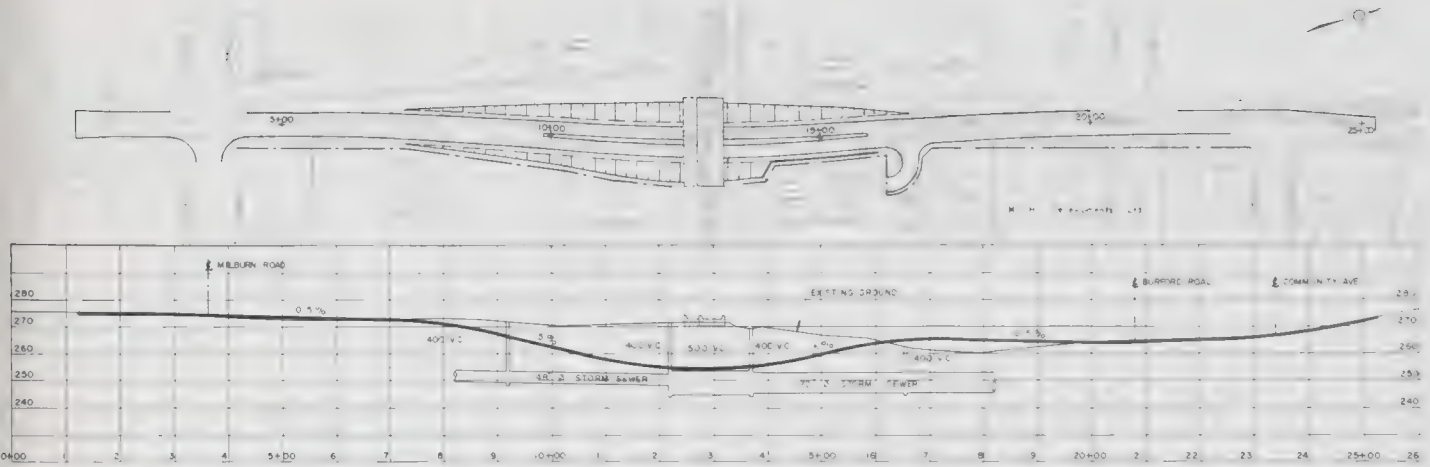
SECTION



ELEVATION

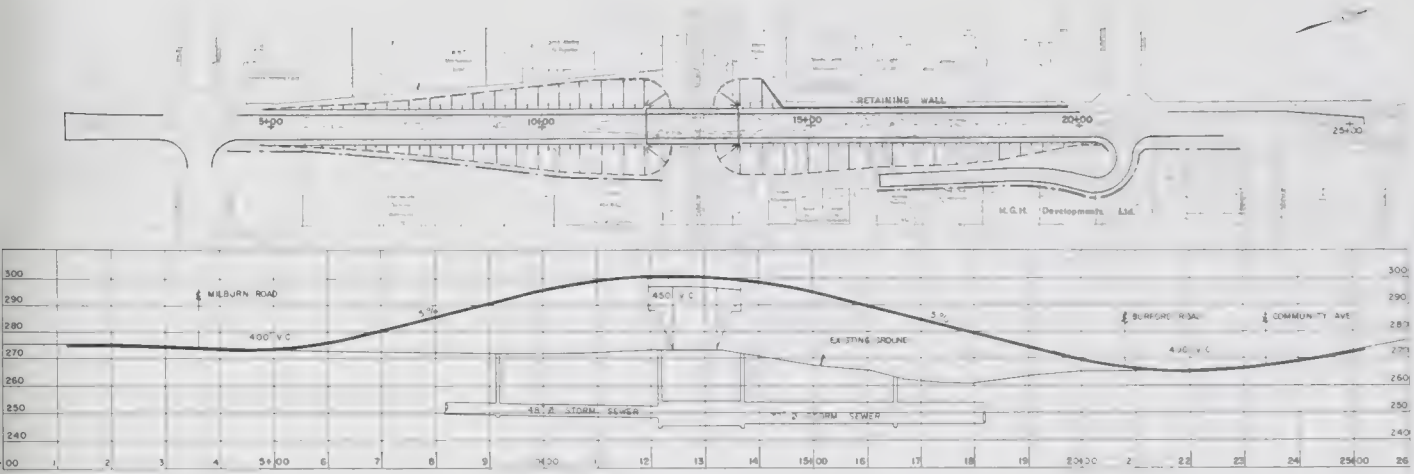
GRADE SEPARATION (SUBWAY)

Exhibit 6



SCHEME 'B'

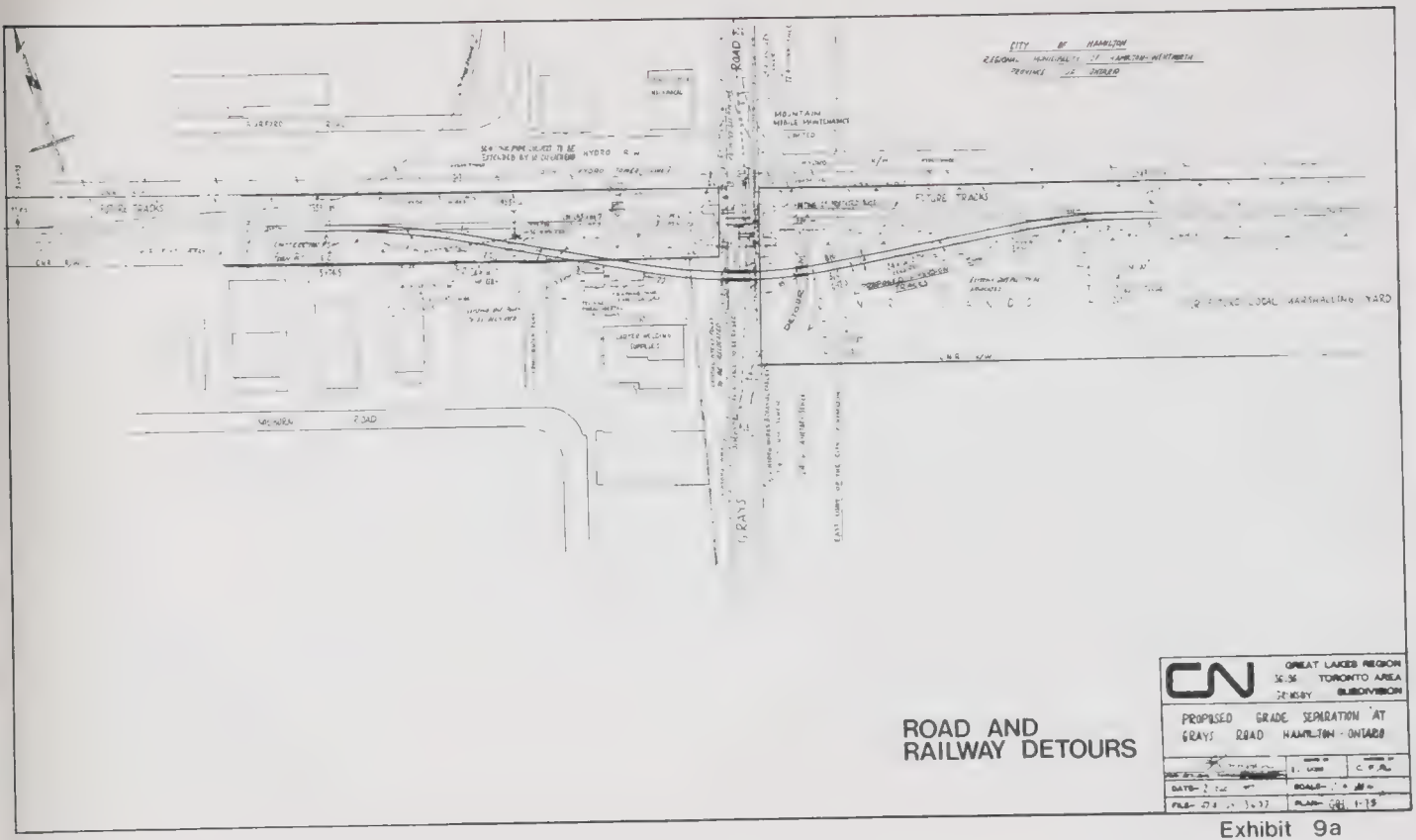
SCALES 1" = 200' HOR
40' VERT



SCHEME 'C'

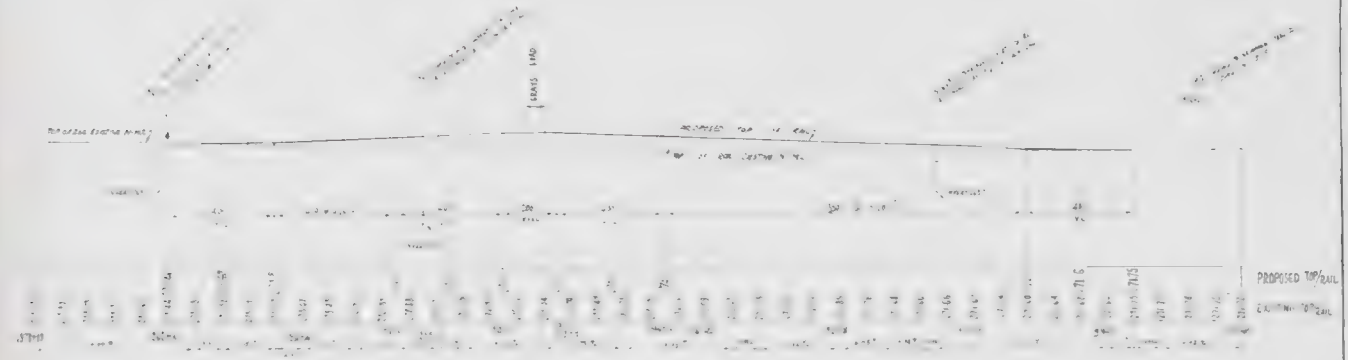
SCALES 1" = 40' HOR.
1" = 4' VERT.

Exhibit 8



ROAD AND
RAILWAY DETOURS

Exhibit 9a



PROFILE OF NORTH MAIN LINE

SCALES HORIZONTAL 1" = 200'

NOTES

1. SUB GRADE AND TYPICAL BALLAST SECTION FOR MAIN LINES TO CONFORM TO PLAN # T.S 2604 AND T.S 2205
2. ALL UNDERGROUND UTILITIES UNDER TRACKS TO CONFORM TO C.T.C. GENERAL DRAWING # G-2
3. ALL CLEARANCES FOR TRACKS TO CONFORM TO C.T.C GENERAL ORDER # G-2
4. ALL CLEARANCES FROM ℄ OF TRACK TO FLAMMABLE LIQUID STORAGE STRUCTURES MUST CONFORM TO C.T.C GENERAL ORDER # O-38.
5. USED O.H.D. B.M # 740491 - SW CORNER OF QN BRIDGE QUEEN ELISABETH HWY AND GRAYS ROAD - ELEV 281.08
6. DIVERSION TO BE FENCED AND ALL EXISTING FENCES TO BE RESTORED UPON REMOVAL OF DIVERSION
7. SPEED ON THE DIVERSION TRACKS - 30 M.P.H
8. SIGNAL BOOT LEGS AT INSULATED JOINTS MAY HAVE TO BE RAISED AT SWITCH POINTS FOR SIDING # S-14, S-15 & S-28

REVISED TO FEB 78 PROFILE & LEAD DETAIL

PROPOSED RAILWAY PROFILE

CN GREAT LAKES REGION
36.36 TORONTO AREA
SUBDIVISION

PROPOSED GRADE SEPARATION AT GRAYS ROAD HAMILTON - ONTARIO

DATE- SCALE-

FILE- PLAN- 36.1-75

Exhibit 9b

APPENDICES

APPENDIX A

NATURAL ENVIRONMENTAL FEATURES

GRAYS ROAD
VEGETATION INVENTORY AND ANALYSIS
PHASE I

prepared for

C.C. Parker and Associates Limited
688 Queensdale Avenue East
Hamilton, Ontario

by

Ecoplans Ltd.
Waterloo, Ontario

November 1977

INTRODUCTION

This report is prepared for C.C. Parker and Associates Limited, as per verbal instructions from Mr. D. Coutts on October 27, 1977.

The objectives of this report are to inventory vegetation, identify valuable vegetation, and to recommend landscaping for Grays Road after construction.

METHODOLOGY

The entire study area was field inspected by Mr. S.E. Amster, Ecoplans Ltd. Forester, on November 9, 1977. All shrubs and trees were assessed on the basis of biological health and vigour, and characterized by species, size, form and quality. Herbaceous vegetation was not assessed due to the late field season.

All inventoried vegetation was ranked high, medium or low to identify priorities for preserving vegetation.

RESULTS

Grays Road vegetation is indicative of new commercial-industrial areas, varying from abandoned, weed-colonized fields, through old non-productive orchards, to recently sodded and landscaped green spaces in front of industrial buildings. The older residential buildings are typically landscaped with foundation junipers or cedars, roses and privet hedges. A few weeping willows are located on front lawns of these homes.

CONCLUSIONS

The vegetation along Grays Road is not considered to be significant, and can as easily be replaced as preserved. The few large willows located on residential front lawns are attractive, but are approaching the size where their roots interfere with sewers or watermains and the large limbs become wind-hazards.

RECOMMENDATIONS

1. Existing vegetation in the Grays Road study area should not be considered a constraint to road construction.

2. The large weeping willow trees are approaching the size where they are considered liabilities in urban areas. These trees could be preserved, but no special effort should be made to do so. Weeping willows should not be replanted along Grays Road.

3. Post-road construction landscaping should be developed to be aesthetically attractive, biologically functional and of low maintenance. The following should be considered for this purpose:

   a) A unifying landscaping programme for the entire Grays Road area should be attempted to avoid the haphazard landscaping currently being developed along the new commercial strip.

   b) Utilization of turf (Kentucky Blue Grass) should be minimized, with perennial ground covers substituted.

   c) Shrubs and trees should be selected on the basis of site suitability, wildlife habitat and screening ability. Mixtures of native viburnum, dogwoods, sumacs, with southern hardwoods (e.g. black gum, sassafras, black oak or sycamore) would be ideal along the railway lines, between buildings and the road, or surrounding parking lots.

APPENDIX B

PRELIMINARY SOILS INVESTIGATION

PRELIMINARY SOILS INVESTIGATION
C.N.R. OVERPASS
IMPROVEMENTS TO GRAYS ROAD
STONEY CREEK, ONTARIO

prepared for

C.C. Parker and Associates Limited
688 Queensdale Avenue East
Hamilton, Ontario

by

The Trow Group Limited
Hamilton, Ontario

October 18, 1977

INTRODUCTION

A field boring program was carried out by the Trow Group Limited on September 28, 1977 at the site of the proposed overpass. This work was authorized by your Mr. D.W. Coutts in your letter of September 26, 1977.

The investigation was undertaken to examine the geotechnical conditions at the site in order to present preliminary design data and to comment on construction procedures and possible problems from a soil mechanics standpoint.

PROCEDURE

The boring was put down on September 28, 1977 with continuous flight auger equipment operated by LandTest Limited, under the direction and supervision of The Trow Group Limited. Soil samples were recovered at regular intervals for visual and textural classification and for laboratory testing purposes. The consistency of the material was determined by in-situ Standard Penetration tests performed in accordance with ASTM

specifications D1586, and field vane shear tests. Water levels were observed in the temporarily open boring.

The borehole was located as indicated on Drawing No. 1 and the adjacent groundsurface elevation established. The top of the coping at the NE corner of the north headwall of the culvert under the CNR tracks, 374 feet west of Grays Road (Township of Saltfleet Benchmark No. 1) was used as the Benchmark. Its elevation was given as 264.07 feet and is referenced to the Geodetic datum.

Laboratory work consisted of natural moisture content and unit weight determinations on the recovered soil samples.

SITE AND SUBSURFACE CONDITION

The proposed CNR overpass is located on Grays Road, North of Barton Street in Stoney Creek, Ontario where the topography is fairly level and the land use primarily industrial. Two railway tracks of approximate East-West alignment form the existing level crossing with Grays Road.

The subsurface conditions are as detailed on the attached Borehole Log, Drawing 2. The significant material encountered is brown to grey silty clay till with traces of sand and gravel. The consistency profile as indicated by Standard Penetration Resistance (N) values is hard in the upper twelve feet of weathered crust, generally very stiff for the next forty feet and hard below fifty two feet depth. Unit weights are typically 135 pcf, but could be as low as 130 pcf in the upper seven feet and greater than 140 pcf below sixty five feet depth.

Bedrock was not encountered during the investigation and is likely to be below Elevation 200 feet. Experience indicates that the bedrock is shale of the Queenston Formation.

The level of free water was not established by long term observations. However, on the basis of field observations and a review of the natural moisture content of the recovered soil samples it is expected that the stabilized groundwater is likely to be at Elevation 260 feet approximately.

FOUNDATION CONSIDERATIONS

Geotechnical conditions at the site for the proposed overpass indicate that the most suitable foundation alternative for the structure is conventional spread footings founded on fairly shallow depths in the silty clay till. If piled foundations are considered, pile lengths in excess of 70 feet are anticipated and final design data should be established after additional investigation.

(i) Spread Footings

An assessment of the available information on the subsurface conditions at the site indicates that the proposed overpass can be founded on spread footings in the silty clay till designed for an allowable bearing capacity of 4 tsf above Elevation 260 feet and 2 tsf below that level. At least 4 feet of cover should be provided to protect the footings from frost action.

Alternatively, the bridge abutments may be founded in the approach embankments on spread footings designed to exert 2 tsf bearing pressure provided that the following conditions are observed:

(1) The approach embankments within the zone significantly influenced by the footing stresses are constructed of well graded granular soils placed on competent natural ground and uniformly compacted to at least 100 per cent of the Standard Proctor Maximum Dry Density.

(2) Any straight line drawn down from the lower edge of the abutment footings at 3 horizontal to 1 vertical does not intersect the fill surface or final adjacent grade.

(3) Four feet of cover is provided for frost protection.

Settlements of the footings will be dictated by the approach embankment loading.

(ii) Piled Foundations

End bearing piles driven to practical refusal in the underlying Queenston Shale bedrock can also be used to support the bridge abutments. Based on the available information pile lengths in excess of seventy feet are anticipated.

Displacement piles such as steel pipe and precast concrete piles driven to practical refusal in the underlying bedrock can be designed for end bearing capacities of 100 tsf.*

Steel H-section piles can support design end-bearing pressures of 7000 psi* when driven to practical refusal in the bedrock. Disadvantages associated with the use of steel H-piles include possible relaxation after driving with a corresponding reduction in capacity, and the difficulty in predetermining the depth to practical refusal.

Set criteria can be established using the Modified Engineering News Record Formula for the given driving system. Higher capacities for piles may be available but must be confirmed by additional investigation and increased technical supervision during installation.

EMBANKMENTS

Approach embankments for the overpass are expected to be at least 20 feet high. Side slopes of 2 horizontal to 1 vertical should be stable if constructed as recommended below.

The embankments near the abutments should be constructed on a competent base free of organic materials. Fill uniformly compacted to at least 95 per cent of the Standard Proctor Maximum Dry Density should then be used to bring the embankment up to the proposed road base level. The faces of side slopes should be protected from surface erosion by encouraging the growth of deep rooted vegetation.

Settlements will take place during and after construction of the approach embankments. Consolidation tests were not undertaken during this preliminary investigation, however, based on available information we expect the imposed embankment stresses to be less than the previous over consolidation pressure experienced by the native soils. Consequently, settlements should be primarily recompression settlements, a significant portion which will take place during construction. Total settlements are not expected to exceed 5 inches. To minimize

To be confirmed by further investigations.

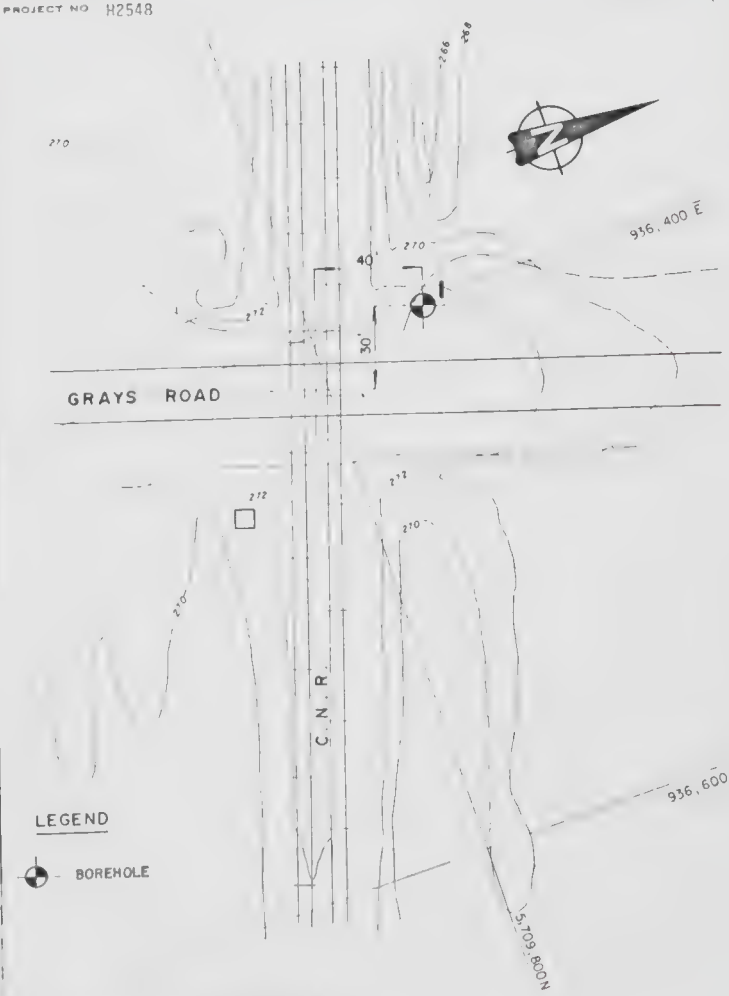
differential settlements between the embankment fill and adjacent abutments (assuming the abutments are founded on practically non-yielding piles) it is recommended that fill be placed as early as practical during construction. This will allow maximum time for consolidation prior to the paving of the final approach embankments.

RECOMMENDATION FOR ADDITIONAL INVESTIGATION

The preceding comments are based on subsurface information obtained for one boring. Prior to the preparation of final designs, at least one additional borehole should be undertaken to verify that the soil conditions are similar across the site, to obtain samples for possible further laboratory tests and to establish the level of bedrock for possible piled foundations design.

PROJECT NO H2548

DRAWING NO 1



SOIL INVESTIGATION
PROPOSED C.P. OVERPASS
GRAYS ROAD STONEY CREEK,
ONTARIO

The Trow Group Limited

BOREHOLE LOG

PROJECT No. H2548 BOREHOLE No. 1 DRAWING No.

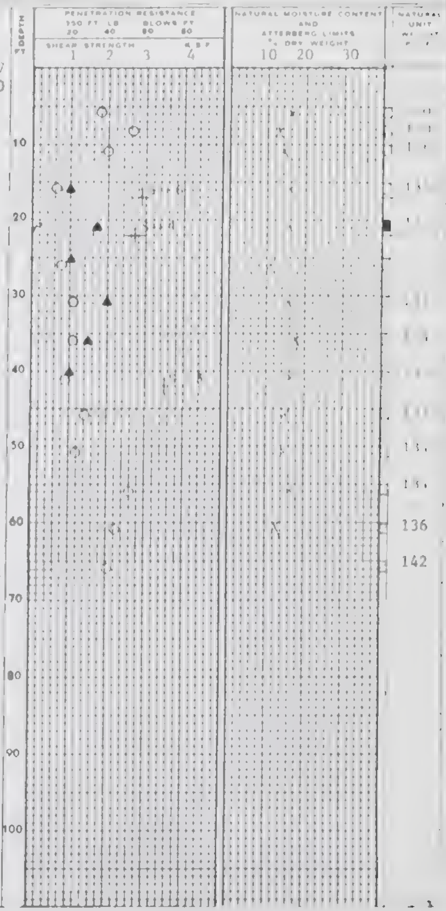
PROJECT: CNR Overpass at Grays Road,

LOCATION: Grays Road
[illegible] Creek, Ontario

HOLE LOCATION AND DATUM SEE DRAWING No. 1

Symbol	Key
2" O.D. SPLIT TUBE	◻
2" I.D. SHELBY TUBE	■
2" DIA CONE	
PUSHED	P
VANE TEST AND SENSITIVITY (S)	+ S
Hand Penetrometer	▲
NATURAL MOISTURE	×
PLASTIC AND LIQUID LIMIT	⊢—○
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE	⊕
% STRAIN AT FAILURE	

SOIL DESCRIPTION	ELEV FEET
FILL-railway ballast, gravel, etc.	271.7
SILTY CLAY TILL-traces of sand and gravel, oxidized fissures in upper levels, occasional grey silt seams, occasional shale fragments, brown to grey, moist, (stiff to hard)	269.0
— TERMINATED —	205.2



NOTES:
[illegible] with [illegible] equipment on September 28, 1977 to 66½ feet depth.
Water Level Records:

ELAPSED TIME	DEPTH TO W.L. (FT)	HOLE OPEN TO (FT)
on completion	dry	64
Oct. 5/77	5*	30.5
Oct. 10/77	5½*	25

[illegible] on October 10, 1977.

*likely influenced by surface run-off.

APPENDIX C

DETAILED COST ESTIMATES

COST ESTIMATE - RECOMMENDED PLAN

	Within Limits of Subway Approaches	Outside of Subway Approaches
Structure (provision for three tracks)	$347,200	$
Retaining Wall	80,000	
Roadworks		
Earthwork	103,000	15,000
Granular base and paving	96,300	65,500
Curb and Gutter	25,800	7,300
Sidewalk	24,000	13,800
Illumination	25,000	
Services		
-Storm & Sanitary	44,200	4,500
-Water	55,500	2,500
Clearing & Grubbing	2,000	
Landscaping	7,500	2,000
Miscellaneous Items (culverts, fencing etc.)	7,500	
Road Detour	20,000	
Rail Diversion		
Borrow	19,000	
Sub-ballast	8,000	
Main Line Reconstruction		
Borrow	4,700	
Sub-ballast	7,600	
Sub total	$ 877,300	$110,600
Eng. and Cont. 25%	219,300	27,700
	$1,096,600	$138,300

	Within Limits of Subway Approaches	Outside of Subway Approaches
Trackage and ballast	$209,500	
Signal works	73,600	
C.N. Telecommunications	14,500	
Reconstruction of the two main lines (tracks, labour, ballast)	150,800	
Utilities		
Ontario Hydro	10,000	
Hamilton Hydro	50,700	
Bell Canada	40,000	56,000
Union Gas	29,000	
Property	143,000	7,000
Sub total	$721,100	$ 63,000
Previous Col.	1,096,600	138,300
Totals	$1,817,700	$201,300

COST SHARING - RECOMMENDED PLAN

Total Cost Eligible for Grant		$1,817,700
Federal Ministry of Transport Special Grant		
80% (1,250,000)	$1,000,000	
+ 60%(1,817,700 - 1,250,000)	340,620	
	$1,340,620	
CN Rail - 5% x 1,817,700	90,880	
Public Utilities		
Hamilton Hydro		
- 26.25% x 50,700	13,310	
Bell Canada		
- 26.25% x 40,000	10,500	
Union Gas		
- 26.25% x 29,000	7,610	
Ministry of Transportation and Communications, 50% x 352,150	177,390	
Regional Municipality of Hamilton-Wentworth, 50% x 352,150	177,390	

Total Cost Not Eligible for Grant		$201,300
Bell Canada	$47,000	
Ministry of Transportation and Communications, 50% x 154,300	77,150	
Regional Municipality of Hamilton-Wentworth, 50% x 154,300	77,150	

APPENDIX D

RAILWAY RELOCATION AND CROSSING ACT FORMULA FOR RANKING APPLICATIONS

A METHOD FOR RANKING APPLICATIONS UNDER THE RAILWAY RELOCATION AND CROSSING ACT PART II and PART III

ELIMINATION AND NEW ALIGNMENT PROJECTS

The following formula is proposed as a method for ranking applications under Part II and Part III of the Railway Relocation and Crossing Act:

$$\frac{\text{Cost}}{\text{Risk}} \text{ Ratio } ^{**}$$

$$\frac{\text{Total Cost of Project Within RTC Limits Eligible for a Grant}}{(V_e T_e + 1/2\, V_d T_d)\ (1 + K_{speed} + K_{geometrics} + K_{fatality})}$$

(1) FACTOR - $(V_e T_e + 1/2 V_d T_d)$

	Existing	Design Year (15 Years +)
Average Annual Daily Traffic	V_e	V_d
Daily Number of Trains	T_e	T_d *

* Maximum value provided by Railway

** Including Utility Relocation Costs

(2) FACTOR - K_{speed}

K_{speed} varies from 0.0 to 1.0 in the following way:
SPEED = Speed of Trains + Posted Speed of Road

Where there is more than one speed for trains, the highest value should be used.

TABLE - 1

If Speed is (Kilometres)	K_{speed}
115 or less	0.0
145	0.2
175	0.4
210	0.6
240	0.8
275 or more	1.0

(3) FACTOR - $K_{geometrics}$

$K_{geometrics}$ is subjectively chosen according to the overall condition of the site related to such things as number of tracks, skew angle, grades, site distance.

The factor varies from: Good Geometrics = 0.0
Fair Geometrics = 0.5
Bad Geometrics = 1.0

(4) FACTOR = $K_{fatality}$

$K_{fatality}$ is related to the occurrence of fatalities at the crossing over the last 10 years. This always applies to existing level crossing sites, and could apply to existing grade separations where the structure itself is a hazard. It may also be applied to New Alignment Projects by considering the occurrence of fatalities at the existing crossing(s) from which traffic is diverted to the new facility and pro rating the number of fatalities based on the percentage of traffic diverted to the new facility.

The factor varies from 0.4 if there has been only one year over the last ten in which one or more fatalities occurred. The factor can be as large as 4.0 if in every year over the last 10 one or more fatalities occurred. The data

would be indicated in the following way:

Year	75	74	73	72	71	70	69	68	67	66	Total
No. of Fatilities	-	1	-	2	-	-	1	-	4	-	8

In this case the $K_{fatality}$ would be 1.6 since fatilities occurred in 4 out of the 10 years considered.

(5) Special Conditions

Special Conditions related to the particular site which require an elaboration or have not been addressed by any of the preceding factors, would require an explanation.

Such conditions would include:

(a) acute pedestrian hazard due to the proximity of a school;
(b) high volume of trucks;
(c) high volume of buses;
(d) special weather conditions in the area, such as fog;
(e) significant peaking characteristics of road traffic at the site:

Examples:

(a) $\frac{SADT}{AADT}$ greater than 1.3 (Rural)

(b) DHV as a percentage of AADT greater than 20% (Urban)

ELIMINATION PROJECT

Location and Type	Proposed Year of Construction	Average Annual Daily Traffic 2-Way		Daily Number of Trains 2-Way		Train Speed & Road Speed Combined Speed			Project Cost
		Initial Year Ve	Design Year Vd	Initial Year Te	Design Year Td	K_{speed}	K_{geom}	K_{fat}	
1. Grays Road	1983	5800 (1977)	10500 (1987)	32 (1977)	52 (1987)	65 + 30 = 95 mph (154 kph) = 0.23	0.0	0.0	$1.82 M.
2. CN Grimsby Subdivision Mileage 36.97									

$$\text{Cost Ratio Risk} = \frac{\text{Cost of Project Eligible for Grant}}{(Ve\ Te + 1/2\ Vd\ Td)(1 + K_{speed} + K_{geom} + K_{fat})}$$

$$= \frac{1.82 \times 10^6}{(5800 \times 32 + \frac{10500 \times 52}{2})(1 + 0.23)}$$

$$\frac{1.82 \times 10^6}{564,078} = \boxed{3.23}$$

APPENDIX E

PHOTOS

LOOKING SOUTH FROM C.N.R. CROSSING

LOOKING NORTH FROM C.N.R. CROSSING

LOOKING SOUTH FROM BURFORD ROAD

LOOKING NORTH FROM MILBURN ROAD